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THURSTON.

American Society of Civil Engineers.

PROCEEDINGS.

Vol. III. January, 1877.

MINUTES OF MEETINGS.

(Abstract of such as may be of general interest to members.)

OF THE SOCIETY.

JANUARY 3D, 1877.—A regular meeting was held at 8 o'clock p. m.

Canvass fixed for this day, of the vote upon admission to membership was called for; reference was made to Art. XX, of the Constitution, whereby it is affirmed that "the results shall be announced at the next regular meeting held after thirty days have elapsed from the time of mailing the notification," and the canvass was deferred until the next regular meeting.*

A paper, by John T. Fanning, C. E., of Manchester, N. H., on "A Water Conduit under Pressure" was read.

The Chairman of the Committee on Finance presented the report of the Committee on the Report of the Treasurer for year ending October 31st, 1876, which was accepted and ordered to be published with accounts of receipts and expenditures of the Society during that period.

The death on December 14th, of George W. R. Bayley, C. E., late of New Orleans and Member of the Society from July 24th, 1872, was announced, and W. Milnor Roberts, Elmer L. Corthell and Caleb G. Forshey were appointed a committee to present a fit memoir of the life and professional services of the deceased.

OF THE BOARD OF DIRECTION.

JANUARY 3D, 1877.—A stated meeting was held at 3 o'clock p. m.; proposals for admission to the Society were considered and other business done.

* A second ballot for applicants to membership and on the appointment of a committee "to report to the Society a form of memorial to Congress" in furtherance of "adoption of the Metric Standards," (Vol. II, page 173,) was subsequently sent, to non-voting Members.

NOTES AND MEMORANDA.

SELECTIONS FROM CORRESPONDENCE.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES.—The following selections from letters received since the resolution submitted for letter ballot, December 6th, "to further, by all legitimate means, the adoption of the Metric Standards in the office of Weights and Measures at Washington," and to "appoint a committee to report to the Society a form of memorial to Congress in furtherance" of this object, was issued.*

MR. AMORY COFFIN writes: In recording my vote against the resolution looking to the appointment of a committee from the Society for the furtherance of the adoption of the metric system, I would ask permission to state reasons why I take such a stand.

In the first place, I think that such legislation would be an arbitrary measure that is foreign to the nature of the American system of government, for "Liberty in things innocent is the birthright of the citizen." Congress has already authorized and legalized its use, and any one choosing to do so, is at perfect liberty to employ the metric system. Further legislation than this would be, in my opinion, undesirable and mischievous.

In the second place, I believe the system itself to be adapted rather to the uses of the scholar and closet theorist than to the practical uses of the shop and the market. The decimal system has been forced upon our currency, but the quotations of Wall street are made in eighths and quarters, and *not* in tenths. The ordinary human mind refuses to think decimal and requires a base that is capable of binary and ternary division.

My third reason is, that the metre is an extremely inconvenient unit in practice. On paper, for purposes of calculation, it is very convenient, but in the field and in the shop it is not adapted to the many and varied wants of practice. It is too inelastic, too rigid, a system. Sometimes eighths, sometimes twelfths or sixteenths are wanted, and to be forced to use the one measure of tenths in all cases would work great practical inconvenience and mischief.

For these reasons, I sincerely trust that the Society will not commit itself to the adoption of the system.

* Vol. II., page 173.

MR. THEODORE COOPER writes: I most decidedly object to any further legislation upon the subject. It is now permissible, and those who desire can employ it. To make it compulsory would be impossible (it has been in France to a certain extent, unjust, and criminal, in so far as it would be a wanton waste of accumulated capital far exceeding in value the amount of our public debt. It looks very pretty on paper. Only decimal fractions hereafter; away with vulgar fractions (a strong emphasis on the vulgar)! Now, for what purpose this change—because it is more natural or more scientific? It certainly is not the former, for the average mind cannot conceive tenths. There is no example, I believe, on record of any people adopting any such division voluntarily. Halves, thirds, and their combinations are the natural divisions in all the walks of life. The broker counts in eighths, not in mills; the ladies divide the yard into eighths; the mechanic naturally falls into halves, quarters, eighths, &c., down to sixty-fourths, for having conceived one of these steps, he can advance by subdividing his conception by two.

It is no more scientific, for the standards are similarly "pieces of metal"—one located in Paris, the other in Washington. One is supposed to be a fraction of a certain arc of a meridian, and the other a fraction of the seconds pendulum at a certain locality—neither, probably, what they ought to be; but the real standards, as determined by law, are the pieces of metal aforesaid.

Our foot can be used for all the purposes which the metre can, for we can count it in tens, hundreds, and thousands, or in tenths, hundredths, &c.,—similarly for square and cubic feet. As for the beautiful nomenclature which may be part of the attraction, why not request a committee of Greek professors to get up one, for the use of those who may desire it?

The only other argument I can see in favor of the metre is, that some other nations are adopting it. Now, do the gentlemen who advocate this measure consider that of the millions of people in the United States, but a small percentage are interested or affected by the kind of standard used in other countries? Yet they desire the government to compel

every man, woman, and child in the United States not only to lay aside their measures of length, width, and contents—thus wiping out of existence millions of dollars' worth of property—but also that capital which cannot be estimated, the accumulated experience of years based upon our present standards. It would be a more onerous tax than has ever before been inflicted upon a people, and a more unreasonable one.

Let those who wish, use the metric system, but do not let the Society make itself ridiculous by advocating any such compulsion. If it has advantages, let the law of national selection test its merits.

AMERICAN TUNNELING.—In Proceedings for March* it was announced that Mr. Henry S. Drinker, Mining Engineer, was engaged in preparing a general treatise on this subject, and engineers throughout the country were asked to assist in collecting data and facts relating to tunnel construction.

Referring to the work in hand, Mr. Drinker writes (December 22d last):

To answer fully inquiries concerning the progress of my Treatise on Tunneling, I must refer to the date of the first announcement of the work, which it will be perhaps remembered was during last spring; this announcement was made in order that, in addition to the material previously quietly collected and compiled, I might also have the advantage of general returns on the subject from engineers through the country at large, who might be interested in getting out a full report on American tunneling.

Owing to the immediate support and endorsement the work received through the kindly notices of the "Railroad Gazette," "Engineering and Mining Journal," "Railway World," and other technical periodicals, the project became pretty widely known to engineers through the country, and I was encouraged by the immediate receipt of many

very valuable returns; others have been coming in continually during the past summer and autumn, literally from all parts of the world, as only a few days since I received, through the kindness of one of the Members of your Society, a complete and most interesting report on the tunnels of New Zealand, especially prepared for my work by a friend of his in charge out there. Returns are also expected from India and Australia; others from Chili, Peru, and Brazil are at hand; the two latter as yet in an incomplete condition.

The returns from the United States, as I said above, have been very full, but my friends of the profession who have been so kind in giving their aid and assistance in the collection of data, must now bear with me in patience, long enough to allow of this large mass of material being properly and systematically arranged and presented. There are a thousand difficulties in getting out a work like this that a man never thinks of until he has to meet them; one of my most serious obstacles has been the fact that, owing to the large number of illustrations of timber and mason work, lithographic plates, etc., necessary—and the expense of publication, was therefore found to be very heavy.

The translations that will be combined with the work have been carefully selected from Rziha's "Lehrbuch der Gesammten Tunnelbaukunst," Shoen's "Tunnelbau," Lorenz' "Tunnelbau," Pressel and Kaufmann's "Bau des Hauenstein tunnels," the records of the Corps des Ponts et Chaussées, and other German and French works. They are now nearly finished, and were already partially done last spring, at the time when I hoped to bring out a first volume in advance of the balance of the work, but was stopped by the increased expense such a course would have necessitated. I am now writing, tabulating, and finishing as fast as possible, and hope to be able, before long, to say that the end has been reached.

* Vol. II., page 45.

LIST OF NEW BOOKS ON ENGINEERING AND TECHNOLOGY.

Under this head will be announced new books on these and kindred subjects, which may be professionally useful to members of the Society.

Art, a Plea for — in the House, with special reference to the Economy of cultivating Works of Art and the Importance of Taste in Education and Morals. W. J. Loftie, London. 12mo. *Macmillan, (New York.)* 2s. 6d.

Astronomical Lectures. No. 5. Measurement of the Sun's Distance. John Harris. London. 8vo. *Trubner.* 2s.
Beetle, Potato Peas, being an Illustrated Account of the Colorado Potato Beetle, and the other Insect Foes of the Potato in North

America; with Suggestions for their Repression and Methods for their Destruction. Charles V. Riley. New York. 12mo, illus. *Judd*. \$0.75.

Birds, the Land and Game — of New England; with Descriptions of the Birds, their Nests and Eggs, their Habits and Notes. H. D. Minot. Salem. 8vo, illus. (*Boston, Estes & Lauriat*) \$3.00.

Boiler Explosions. Return of Committee. (Parliamentary Report.) London. 8vo. 6d.

Botany. New Illustrated Plant Record. Alphonse Wood. New York. 8vo. *Barnes*. \$1.00.

Chemistry. The Science Examiner. Inorganic Chemistry. J. Mouskman. Leeds. 12mo. (*Simpkin, London*) 4d.

— An elementary Treatise on practical and qualitative inorganic Analysis. Frank Clowes. London. 12mo. (*Lindsay & Blakiston, Philadelphia*. Announcement.)

Coal, spontaneous Combustion of —. (Parliamentary) Report and Evidence. London. 8vo. 3s.

Drawing from Nature; a Series of progressive Instructions in Sketching; to which are appended Lectures on Art; delivered at Rugby School. George Barnard. New ed. London. 8vo, illus. *Routledge*. 2ls.

Education. Report of the Commissioner of — for 1875. Washington. 8vo. *Gov. Printing Office*.

Encyclopaedia Britannica, a Dictionary of Arts, Sciences, and general Literature. Ninth ed. Vol. V. Edinburgh. 4to. illus. (*Little, Brown & Co., Boston*) \$9.00.

— of Universal Information (the Globe). Ed. by John M. Ross. Vol. 2. Edinburgh. 4to. illus. *Jack* (*London, Simpkin*) 12s. 6d.

Fire Surveys, a Summary of the Principles to be observed in Estimating the Risk of Buildings. E. M. Shaw. 2d ed. London. 12mo. *Wilson*. 5s.

Friction, a Treatise on the Theory of —. John H. Jellett. Dublin. 8vo. (*Simpkin, London*) 8s. 6d.

Fungi, a plain and easy Account of British — with special Reference to the esculent and economic Species. M. C. Cooke. 3d ed. rev. London. 12mo. illus. *Hardwicke*. 6s.

— Mushrooms and Toadstools: how to distinguish easily the Differences between edible and poisonous Fungi. G. Worthington Smith. 3d ed. London. 12mo. illus. *Hardwicke*. 1s.

Geometry, inventional —: a Series of Problems, intended to familiarize the Pupil with geometrical Conceptions, and to exercise his inventive Faculty. William George Spencer, with a prefatory Note by Herbert Spencer. London. 18mo. (*Appleton, New York*) \$0.50.

— Simson's Euclid, ed. in the symbolical Form, by R. Blacklock. New ed. London. 18mo. *Simpkin*. 6s.

Geological Observations on the volcanic Islands and Parts of South America visited during the Voyage of H. M. S. "Beagle." Charles Darwin. 2d ed. London. 8vo, illus. *Murray*. 12s. 6d.

Geology. The great ice Age and its Relation to the Antiquity of man. James Geikie. 2d ed. rev. London. 8vo, illus. *Daddy & Ibister*. 24s.

— What the Earth is Composed of? 3 Lectures by Prof. Roscoe. London. 12mo, illus. *Macmillan (New York)*. \$0.25.

Gold; or, legal Regulations for the Standard of Gold and Silver Wares in different Countries of the World. Trans. and abr. from "Die gesetzliche Regelung des Feingehaltes von Gold und Silber Waaren, von Arthur von Studnitz," by Mrs. Brever; with Notes and Additions by Edwin W. Streeter. London. 8vo. *Chatto & Windus*. 3s. 6d.

— and Debt, an American Handbook of Finance, with over 80 Tables and Diagrams illustrative of the following Subjects: the Dollar and other Units; Paper Money in the United States and Europe; Suspensions of Specie Payments; the Era of Gold; Values of the Precious Metals; the Era of Debt; the Rise and Fall of Prices; also a Digest of the monetary Laws of the United States. W. L. Fawcett. Philadelphia. 12mo. *Griggs*. \$1.75.

Health, Relation between topographical Surveys and the Study of the public Health. James T. Gardner. Albany. 8vo.

Insurance, Notes on Life —. Part I, theoretical, Part II, practical; with Appendix and algebraic Discussion. Gustavus W. Smith. 3d ed., rev., enl. and re-arranged. New York. 8vo. *Van Nostrand*. \$2.00.

Iron and Metal Trades Companion; being a Calculator containing a Series of Tables upon a new and comprehensive Plan for expeditiously ascertaining the Value of any Goods bought or sold by Weight, from 1s. per Cwt. to 112s. per Cwt., and from 1d. per Pound to 1s. per Pound; each Table extends from 1 Pound to 100 Tons; to which is appended Rules for Decimals, Square and Cube Roots, Mensuration of Superficies and Solids, &c.; also Tables of Weights of Materials, and other useful Memoranda. Thomas Downie. London. 16mo. *Lockwood*. 9s.

— a Treatise on the Application of —, to the Construction of Bridges, Girders, and other Works. Francis Campin. 2d ed., rev. and cor. London. 12mo. (Weale's Series.) *Lockwood*. 2s. 6d.

Light, the Japan—with which the Japanese Government has provided the leading Ports. R. H. Brenton, with Abstract of Discussion. (Minutes of Proceedings, Institution of Civil Engineers.) London. 8vo, illus. *Inst. Civ. Eng.*

Mechanic's, the operative—Workshop Companion. William Templeton. 12th ed., rev. and enl. London. 18mo. *Lockwood*. 5s.

Metal Trade; Calculator for —. Gavin Wilson. London. *Knight*. 10s. 6d.

Natural History and Antiquities of Selborne. Gilbert White; rev. by James Edmund Harting. 2d ed., with 10 Letters not included in any previous Ed. London. 8vo. *Bickers*. 10s. 6d.

Mining. Transactions of the North of England Institute of mining and mechanical Engineers, September and October. Newcastle-on-Tyne. 8vo.

Orthographic Projection, elementary Treatise on —. William Binns. 8th ed., illus. Vol. I. London. 8vo. *Spons, (New York)*. 9s.

Parks, Third annual Report of the Board of Commissioners of the Department of Public Parks, New York, from May 1st, 1872, to December 31st, 1873. New York. 8vo.

Plains of the Great West and their Inhabitants, being a Description of the Plains, Game, Indians, etc., of the Great North American Desert. Richard Irving Dodge; with an Introduction by William Black

more. New York. 8vo, illus. *Putnam's*. \$4.00.

Problems, Solutions of the Cambridge Senate House Problems and Riders for 1875. A. G. Greenhill. London. 8vo. *Macmillan (New York)*. 8s. 6d.

Projection, the Art of —, a Manual of Experimentation in Physics, Chemistry, and Natural History, with Perte Lumière and Magic Lantern. A. E. Dolbear. Boston. 12mo, illus. *Lee & Shepard*. \$1.50.

Rail joints (on). Extracted from the "Engineer" November 10th and 17th, 1876. C. P. Sandberg. London, folio, illus. *Engineer*. Railways. (Parliamentary Reports.) London. 8vo. Inspectors' Reports on Accidents. Part 5. 2s. 6d. Returns of Accidents, April to June, 1876. 1s. 2d.

—, On the permanent Way of —. R. P. Williams, with Abstract of Discussion. (Minutes of Proceedings, Institution of Civil Engineers). London. 8vo, illus. *Inst. Civil Eng.*

Rivers Pollution Prevention Act, 1876, 39 and 40 Vic., c. 75; with Introduction, Notes and Index. Alexander Glen. London. 12mo. *Knight*. 2s. 6d.

Sanitary Measures, East India —1874-75. Papers. (Parliamentary Reports). London. 8vo. 2s. 2d.

Science. Roger Bacon; the Philosophy of Science in the Middle Ages: an Address, introductory to the Session 1876-7, in the Department of Art, Science and Law, at Queen's College, Manchester. pp. 36. Robert Adamson. Manchester. 12mo. (*Simpkin, London*). 1s.

Ships, the Fleets of the World; the Galley Period. Foxhall A. Parker. New York. 8vo, illus. *Van Nostrand*. \$5.00.

Sorrento and inlaid Work, a Manual of —,

for Amateurs, with original Designs. Chicago. 8vo, illus. (*Am. News Co., New York*). \$1.50.

Steam Engines, the relative Merits of simple and compound Engines as applied to Ships of War, with an Appendix containing Particulars and Analyses of recent Experiments. Neil McDougall. London. 8vo. *Spons (New York)*. \$1.75.

Survey. Report of the trigonometrical Survey of the Island of Hokkaido (Japan) for 1875. M. S. Day. New York. 4to, illus. *Hart*. Trade and Navigation Accounts for October. (Parliamentary Report). London. 8vo. 5d.

Transportation Route along the Wisconsin and Fox Rivers in the State of Wisconsin, between the Mississippi River and Lake Michigan. Report on —. Gouverneur K. Warren. —. Washington. 8vo. *Govt. Printing Office*.

War, Franco-German —, 1870-71. First Part: History of the War, to the Downfall of the Empire. Second Volume (Sections 6 to 9): from the Battle of Gravelotte to the Downfall of the Empire; with case of Maps and Plans. Trans. from German official Account, by F. C. H. Clarke. London. 8vo. 22s.

Water Companies. Metropolitan—. Account for 1875. (Parliamentary Report.) London. 8vo. 5d.

Wood Conversion by Machinery. John Richards. London. 8vo, illus. *Spons (New York)*. \$1.50.

Worsted Pieces; Holdsworth's ready Reckoner for Hanks in worsted Pieces, being Tables giving the net Yarn in Hanks required in Pieces from 5 to 50 Pickles per quarter Inch, 15 to 80 Inches in Width, and 1 to 100 in Length. Bradford. 8vo. (*Simpkin, London*). 21s.

ANNOUNCEMENTS.

MEETINGS OF THE SOCIETY for the next three months will be held as follows: *regular* meetings, when ballots for members will be canvassed, and other business done, Wednesday, February 7th, March 7th, and April 4th; and *stated* meetings, for consideration of professional topics and enjoyment of social intercourse, Wednesday, February 21st, March 21st, and April 18th—each at 8 o'clock p. m.

MEETINGS OF THE BOARD OF DIRECTION during the same term for the transaction of regular business, will be held February 7th, March 7th, and April 4th, at 3 o'clock p. m.

At the next *regular* meeting of the Society (February 7th), ballots for members, and upon the appointment of a Committee to report to the Society a form of Memorial to Congress in furtherance of the adoption of metric standards, will be canvassed. A paper by Henry F. Walling, C. E., of Boston, Mass., on "Co-Ordinate Surveying," will be presented. "Some Facts and Opinions relating to Failure of the Railway Bridge at Ashtabula,

Ohio," will be considered, and other business done.

A General (Quarterly) Meeting of the AMERICAN INSTITUTE OF MINING ENGINEERS will be held in New York, beginning Tuesday, Feb. 27th next, at 8 o'clock p. m. The first, and probably other sessions, will be at the rooms of the Society. It is proposed to have a joint meeting of the two associations before the final adjournment; announcement of the order of arrangements will be made in due time.

RATES OF POSTAGE on transient matter sent to the Society from domestic post-offices, except New York, are as follows:

On books, pamphlets, periodicals, maps and corrected proof sheets, one cent per *two ounces*; on photographs, lithographs, and engravings, one cent per *ounce*; and on letters and other mail matter, either wholly or partly in writing (except corrected proofs), sealed packages, or those wrapped so as not to be conveniently examined without destroy-

ing the wrapper, *three* cents per *halfounce*. The sender may write or print his address in or on a package, and state names and number of articles enclosed, without extra charge.

Matter upon which not enough postage is prepaid, is charged on delivery with *once* or *twice* the deficiency, according to class; and it is not infrequent that from \$0.50 to \$5.00 is thus charged.

The attention of members is called to these conditions. Generally, it is better to forward a package by express when the postage thereon exceeds \$0.35, or the rating is uncertain.

PAPERS HAVE BEEN RECEIVED for presentation to the Society, since the last announcement, as follows:

Levees, a Discussion, (incomplete).

George W. R. Bayley. January 11th, 1877.
Co-Ordinate Surveying.

Henry F. Walling. January 23d, 1877.

TITLE PAGE AND LIST OF CONTENTS of Volume V. Transactions are issued herewith; a topical Index of Volume I, Proceedings, will be published in February Journal, there not having been time for its preparation earlier.

LIST OF MEMBERS.

ADDITIONS.

	Date of Election.
BATTERSON, JAMES G. [F.] Hartford, Conn.....	June 7, 1876.
MENTELL, GEORGE H.....Maj. of Engs., U. S. A.....	Sept. 6, "

CHANGES AND CORRECTIONS.

BECKWITH, ARTHUR.....	Room 54, Coal and Iron Exchange, Cortlandt and Church streets, New York.
BECKWITH, LEONARD F....	Prest. Fire Proof Building Co. of New York, Room 54, Coal and Iron Exchange, Cortlandt and Church streets, New York.
BILLIN, CHARLES E.....	Box 2580, Philadelphia, Pa.
BOUSCAREN, L. G. F.....	Cons. Eng. Cincinnati Southern R'y, Cincinnati, O.
BROOKS, THOMAS B.....	Monroe, N. Y.
CORTHELL, ELMER L.....	South Pass Jetty Co., 122 Common street, New Orleans, La.
DARRACH, CHARLES G.....	3906 Woodlawn street, W. Philadelphia, Pa.
DOANE, EDWIN A.....	Myrtle Block, East Fifth and Utica streets, Oswego, N. Y.
FORD, ARTHUR L.....	80 West Sixth street, Oswego, N. Y.
KENNEDY, JAMES C.....	Care William Kennedy & Sons, Owen Sound, Ontario, Canada.
PETERSON, PETER A.....	Ch'f Eng. Q. M. O. & O. R'y, Montreal, Canada.
POST, ANDREW J.....	136 Magnolia ave., Jersey City Heights, N. J.
SEDGWICK, THOMAS S.....	732 Twenty-first street, N. W., Washington, D. C.
STAATS, ROBERT P.....	349 West Fourteenth street, New York.